LAB # 02

Introduction and understanding the concept of PV Module Using MATLAB

Objective:

- Observe the P-V curve of different PV modules by changing its parameters.
- Observe the P-I curve of different PV module by changing its parameters.
- Observe the behavior of P-V & P-I curve at different value of temperature.
- Observe the behavior of P-V & P-I curve at different value of irradiance.

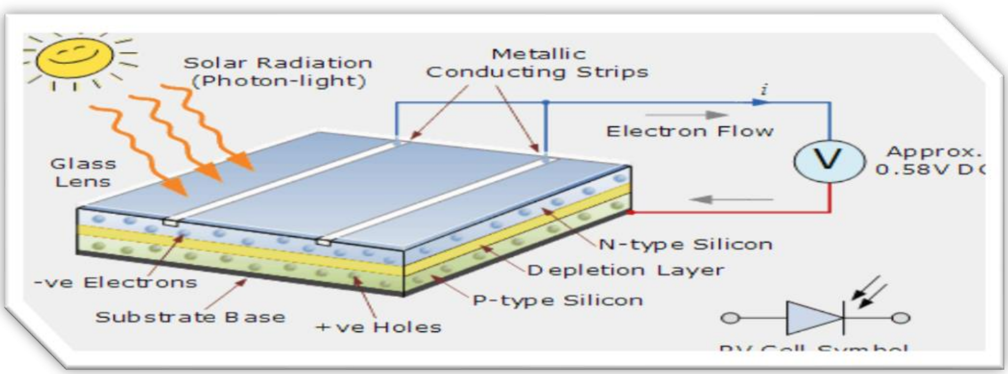
Related theory:

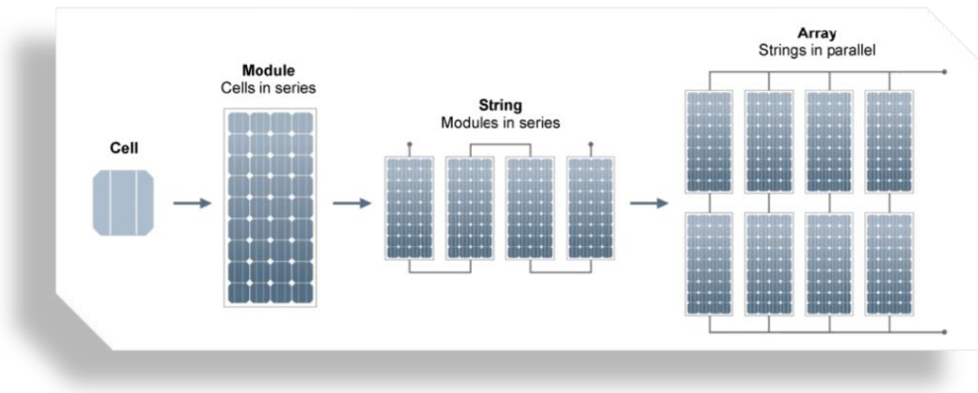
Solar panel refers to a panel designed to absorb the sun's rays as a source of energy for generating electricity or heating.

Photovoltaic modules use light energy (photons) from the Sun to generate electricity through the photovoltaic effect. The majority of modules use wafer-based crystalline silicon cells or thin-film cells. The structural (load carrying) member of a module can either be the top layer or the back layer. Cells must also be protected from mechanical damage and moisture. Most modules are rigid, but semi-flexible ones are available, based on thin-film cells.

Modules electrical connections are made in series to achieve a desired output voltage and/or in parallel to provide a desired current capability. The conducting wires that take the current off the modules may contain silver, copper or other non-magnetic conductive material.

The most common application of solar panels is solar water heating systems.

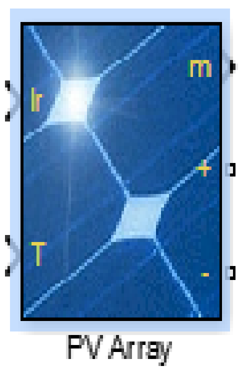


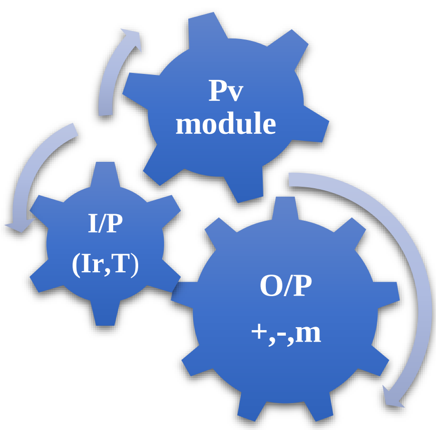


EXPERIMENTAL PROCEDURE:

Software tools**:** Matlab R2015a

PV Module:





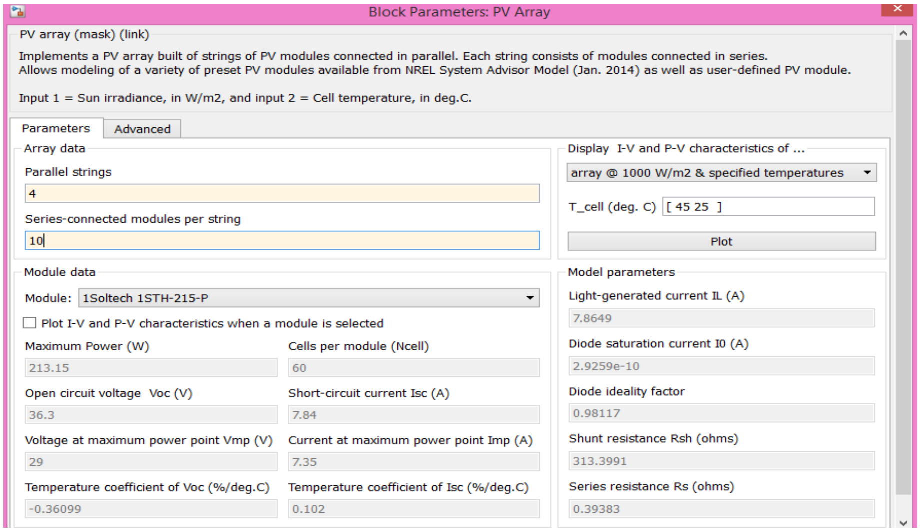
Pin description:

- Input 1 = Sun irradiance, in $^{kW}/_{m^2}$
- Input 2 = Cell temperature, in deg.C

Outputs:

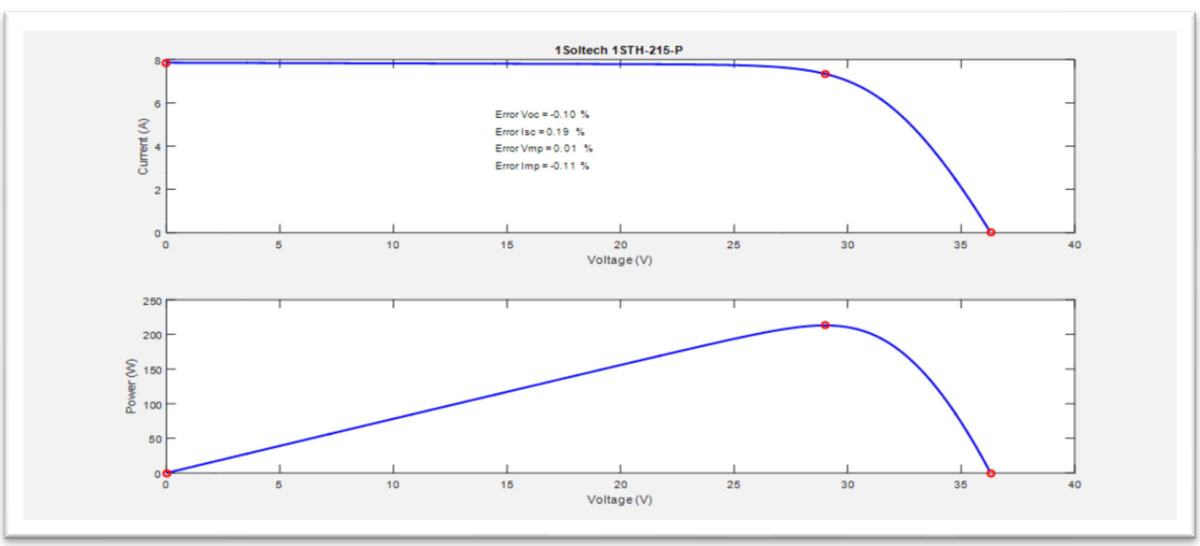
- +, - (dc supply)
- pin (m) shows the properties/parameters of module.

Block parameters: PV Array



Characteristics curve V-I & P-V:

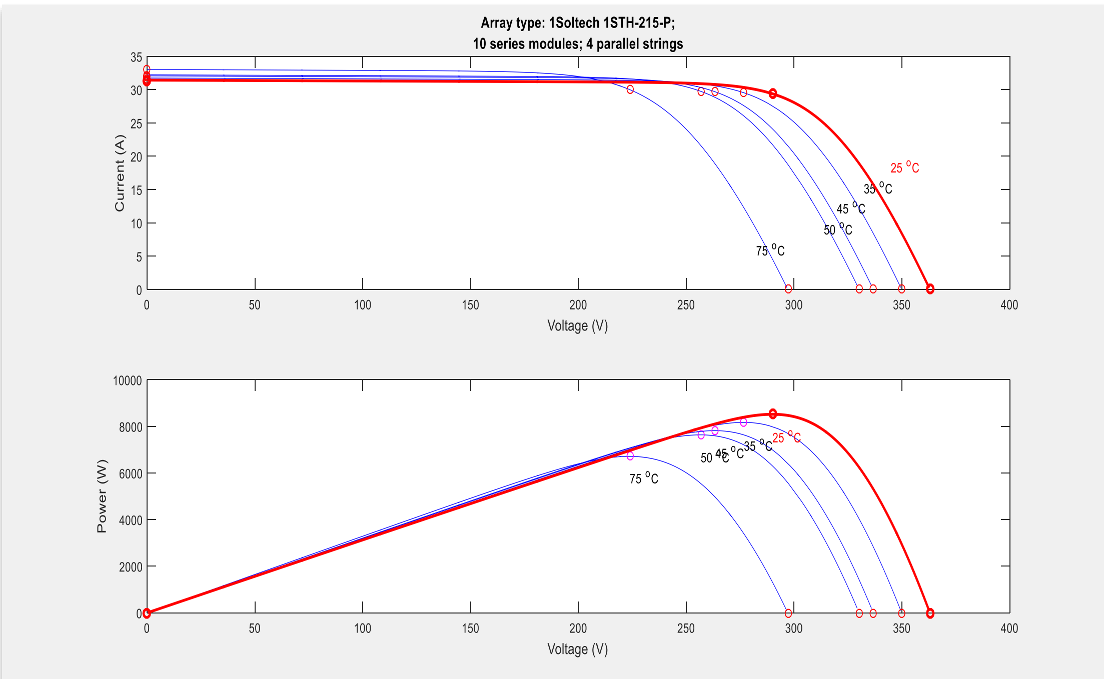
Characteristics curve in fig.1 below describe the relationship between V & I and between power & Voltages. In 1st curve the open circuit voltage or maximum voltage is at 36.5v & the short circuit current or maximum current is 7.9A. The red circle at V=30v describe the maximum power point. The 2nd curve describes the power w.r.t voltage. We observe that at V=30 the power curve is maximum & after maximum power point, the power reduces. At the V_{oc} point, the power is equal to zero, because in case of open circuit the value of current is approaches to zero.



V-I, P-V curve (Figure 1)

Characteristics curve b/w V-I & P-V at different temp:

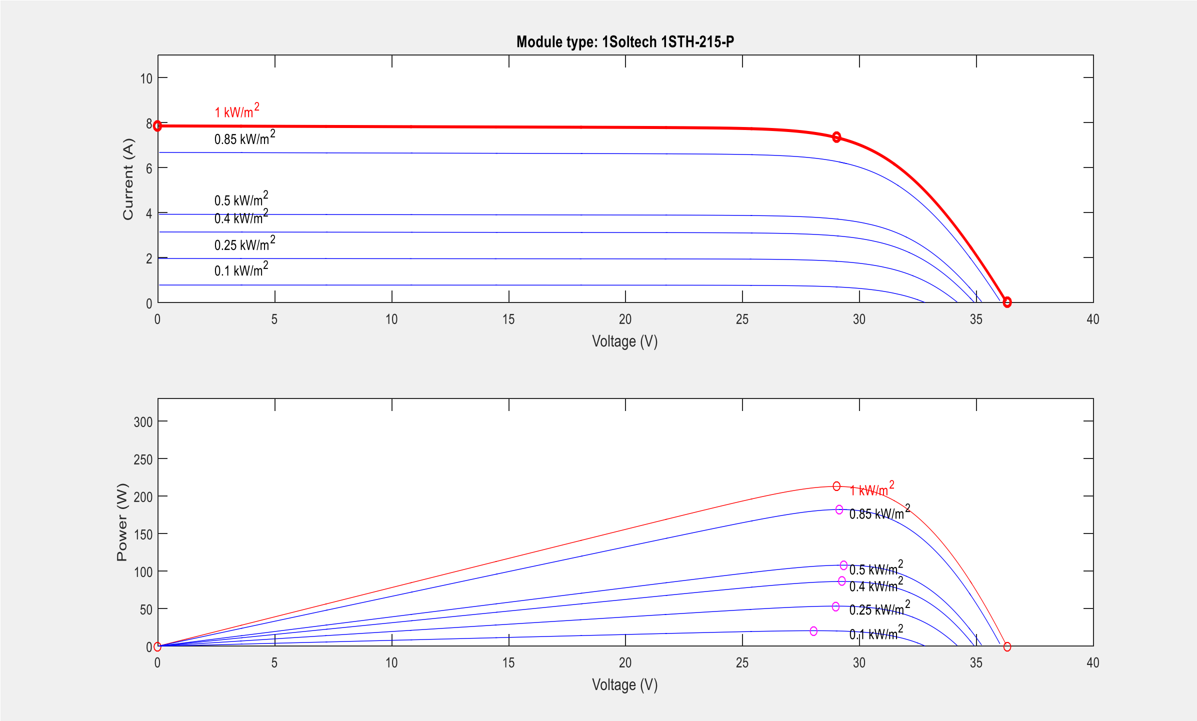
In this module, we observe the V-I & P-V curve (fig.2) at different temperature level. We observe that, at different temperatures, the maximum power point is change due to change in value of current & voltage. In this module, we use 10 series & 4 parallel strings to get desire power at the output. We observe that at 25ºC, the V_{oc} is 350 & at 75ºC the value of V_{oc} is 300. By seeing the curve, we can say that the change in MPP is due to temperature change.



V-I, P-V curve (Temperature Plot) (Figure 2)

V-I & P-V curve at different value of irradiance:

Characteristics curve in figure 3 below represent the value of current, power & voltage at different value of irradiance. In this module, we set the different value of irradiance (1000, 850, 500, 400, 250, 100) $W\ /\ m$^2 . We observe that change in irradiance effect the photonic current (at 1000 irradiance the value of current is 8A & at 250 irradiance the current value is 2A). We can say that as the intensity of sun light increases, the value of current also increases. The relation b/w V & I is logarithmic, so by changing the irradiance, we facing large change in photonic current but small change in V_{oc} due to logarithmic relation.



V-I, P-V Curve (Irradiance Plot) (Figure 3)

Conclusion and Comments:

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